KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.E.
Year : III

Course : CIEG 303
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 07 AUG 2024

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices

1. If porosity is denoted by n, volume of voids is denoted by Vv, volume of solid is denoted by Vs and total volume is denoted by V,
   a. n= V/Vv b. n=Vv/V c. n = Vs/Vv d. n= Vs/V

2. A saturated soil has a dry unit weight of 103 lb/ft3. Its moisture content is 23%, determine saturated unit weight
   a. 103.0 b. 112.4 c. 115.2 d. 126.7

3. As per USCS soil classification what is the range of gravel particles size
   a. Smaller than 0.075 mm
   b. Greater than 4.75 mm
   c. Passing through 75 mm and retained in 4.75 mm
   d. Passing through 75 mm and retained in 0.075 mm

4. If you increase the water content of a soil sample which fall plastic state, which state it will fall on
   a. Semi-solid state b. Solid state c. Liquid d. Will not change

5. A sample of soil is pass through the sieve, D_{10}, D_{30} and D_{60} are 0.075, 0.15 and 0.85, calculate C_c
   a. 0.353 b. 0.535 c. 0.255 d. 0.671

6. If you have a soil sample with 65% passing through the #200 sieve, pick the best suitable option from the given option
   a. Clayey Sand b. Sandy Silt c. Silty Sand d. Poorly Graded sand

7. If permeability of a soil in horizontal and vertical direction is represented by k_x and k_y, what is their effective permeability
   a. $k_e=\sqrt{(k_x \times k_y)}$ b. $k_e= k_x \times k_y$ c. $k_e=k_x / k_y$ d. $k_e=k_x + k_y$

8. Which test is best suited to determine the permeability of the fine-grained soil?
   a. Hydrometer test b. Constant Head test
   c. Falling Head test d. Permeability test

9. The shear strength for saturated clays from unconfined compression test is
   a. Twice the unconfined compression strength
   b. Half the unconfined compression strength
   c. Three times the unconfined compression strength
   d. It is not related to unconfined compression strength

10. If the symbol has the usual meaning, which test is quickest test to run to find out the shear strength parameters of the soil
a. UU b. CU c. CD d. None of the above

11. If permeability of a soil is 10^{-4} m/s, no. of potential drop is 4, no. of flow channel is 6, and head difference is 10 m, calculate the seepage discharge,
a. 1.5×10^{-3} m^3/s b. 0.6×10^{-3} m^3/s c. 2.0×10^{-3} m^3/s d. 1.8×10^{-3} m^3/s

12. What are the main assumptions Rankine had made for his earth pressure theory?
a. Back of the wall is rough
b. Back of the wall is rough and vertical
c. Back of the wall is smooth and vertical
d. Back of the wall is smooth and inclined

13. If you are asked to design the a earth retaining structure based on the Rankine Active Earth Pressure theory. And, the effective angle of internal friction is 35° of the backfill soil, what will be the lateral earth pressure coefficient used in the design.
a. 0.27 b. 0.33 c. 3.6 d. 0.45

14. The effective stress _____.
a. Is equal to the pore water pressure.
b. Cannot be measured in lab, is an abstract quantity
c. Can be measured directly in the lab
d. is total stress plus pore water pressure.

15. If you are constructing the reinforced soil wall and during the construction process you are compacting the backfill, by doing so the reinforced soil wall tends to move away from the backfill, what kind of earth pressure condition it refers to
a. At rest condition b. At passive condition
c. At Active condition d. At intact condition

16. Which LEM method is widely used for the slope stability analysis
a. Janbu b. Bishop c. Swedish Circle d. Morgenstern – Price

17. What does primary consolidation of the soil refer to
a. Expulsion of the air from the voids
b. Reduction of the volume of soil mass by a flow of water from the soil voids
c. Reduction of the volume of soil mass by rearrangement of the soil particles
d. Consolidation of soil after the completion of the secondary consolidation

18. Compaction of the cohesion less soil increases
a. Settlement of the soil after the application of the load
b. Permeability of soil mass
c. Shear strength parameters
d. Void ratio of soil mass

19. Flow net can be used to determine
a. Permeability of soil b. Seepage and permeability only
c. Exit gradient and seepage only d. Exit gradient, seepage and uplift pressure

20. What is 100% saturated soil referring to
a. Voids filled with water only b. Voids filled with water and air
c. Voids filled with air only d. Voids filled with air and solid particles

KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Level : B.E.
Year : III
Time : 2 hrs. 30mins.

01 AUG 2024

Course : CIEG 303
Semester : I
F. M. : 40

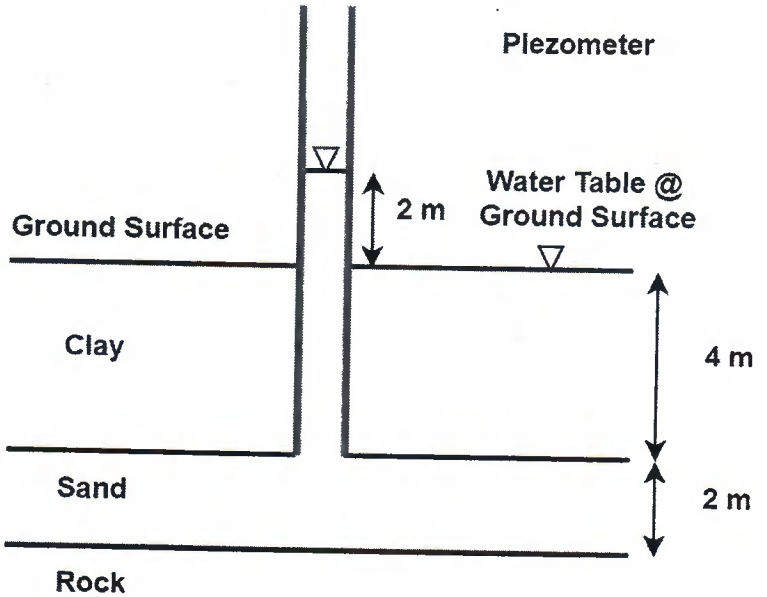
SECTION "B"

Attempt *ALL* questions. Assume suitable data where necessary.

1. Explain three phase diagram and provide a neat sketch of three-phase and two-phase diagrams. A sample of saturated soil has a water content of 25% and a saturated unit weight is 20kN/m^3. Determine dry density, void ratio and specific gravity of the soil particles. [2+3=5]

2. Derive an expression to calculate seepage discharge from a flownet showing the relation between number of potential drops, number of flow channels, permeability of soil and head difference using the Darcy law. Also define equipotential and flow line with a flow net diagram. [4+1=5]

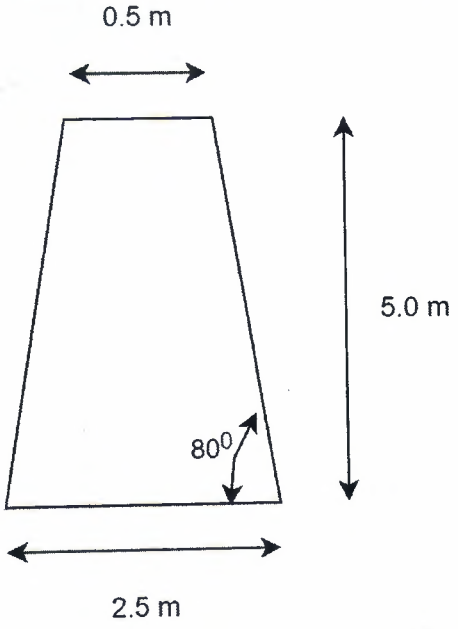
3. A soil profile consists of a surface layer of clay 4 m thick (sat. unit wt. = 19.5 kN/m^3) and a sand layer of 2 m thick (sat. unit wt. = 18.5 kN/m^3) overlying an impermeable rock. The water table is on the ground surface. If the water level in a standpipe (piezometer) driven into the sand layer rises 2 m above the ground surface, determine total and effective stress. (Note: This artesian head, which is given by piezometer is only acting on the sand layer, it has no effect on the clay layer). [6]



4. A clay layer 5.0m thick is below a layer of incompressible soil strata, 4 m in thickness. The clay has compression index (C_c) of 0.22 and moist unit weight of 18 kN/m^3. The initial void ratio of clay is 1.30. Calculate the final settlement of clay layer due to an increase in pressure of 30 kN/m^2. Also calculate the settlement when the water table rises to the ground surface and the saturated unit weight of clay is 19 kN/m^3. Take unit weight of incompressible strata as 20 kN/m^3 for both cases. [6]

P.T.O.

5. A retaining wall of stone masonry is shown below, which has a smooth back retains a cohesionless backfill. The unit weight and angle of internal friction of the retained backfill are 18 kN/m^3 and 30° respectively. Check the stability of the retaining wall against overturning if the unit weight of stone masonry used is $24kN/m^3$. [8]



6. Define factor of safety based on mechanics of limit equilibrium for slope stability. What are different equilibrium conditions for slope stability? Please compare Swedish circle, Ordinary method slices, Simplified Bishop methods. [1+1+3]

7. Differentiate between soil compaction and consolidation of soil. If you are provided with the soil samples from the field, how do you determine the optimum moisture content and the maximum dry unit weight of the soil? Please write the steps with figures, if necessary. [1+4]